TARGET 3: Develop a cooperative program to restore and maintain riparian habitat along Big Chico Creek (◆◆◆).

PROGRAMMATIC ACTION 3A: Cooperate with local landowners to encourage revegetation of denuded stream reaches and to establish, restore, and maintain riparian habitat on Big Chico Creek.

TARGET 4: Develop a cooperative program to restore and maintain riparian habitat along Butte Creek (◆◆◆).

PROGRAMMATIC ACTION 4A: Cooperate with local landowners to encourage revegetation of denuded stream reaches and to establish, restore, and maintain riparian habitat on Butte Creek.

RATIONALE: *Many wildlife species, including several listed as threatened or endangered under the State and federal Endangered Species Acts (ESAs), and several special-status plant species in the Central Valley, depend on or are closely associated with riparian habitats. Riparian habitats support a greater diversity of wildlife species than all other habitat types in California. Riparian habitat degradation and loss have substantially reduced the habitat area available for associated wildlife species. This habitat loss has reduced water storage, nutrient cycling, and foodweb support functions.*

FRESHWATER FISH HABITAT AND ESSENTIAL FISH HABITAT

TARGET 1: Maintain and improve existing freshwater fish habitat and essential fish habitat through the integration of actions described for ecological processes, habitats, and stressor reduction or elimination (◆◆).

PROGRAMMATIC ACTIONS: No additional programmatic actions are recommended.

RATIONALE: *Freshwater fish habitat and essential fish habitat are evaluated in terms of their quality and quantity. Actions described for ecological processes, stressor reduction, and riparian and riverine aquatic habitat should suffice to maintain and restore freshwater fish habitat and essential fish habitat.. For example, maintaining freshwater and essential fish habitats is governed by actions to maintain streamflow, improve coarse sediment supplies, maintain stream meander, maintain or restore connectivity of creeks in this ecological management zone and their floodplains, and in maintaining and restoring riparian and riverine aquatic habitats.*

AGRICULTURAL LANDS

TARGET 1: Cooperatively manage 108,832 acres of agricultural lands (◆◆).

PROGRAMMATIC ACTION 1A: Increase the area of rice fields and other crop lands flooded in winter and spring to provide high-quality foraging habitat for wintering and migrating waterfowl and shorebirds and associated wildlife.

PROGRAMMATIC ACTION 1B: Convert agricultural lands in the Butte Basin Ecological Management Zone from crop types of low forage value for wintering waterfowl and other wildlife to crop types of greater forage value.

PROGRAMMATIC ACTION 1C: Defer fall tillage on rice fields in the Butte Basin Ecological Management Zone to increase the forage for wintering waterfowl and associated wildlife.

RATIONALE: *Following the extensive loss of native wetland habitats in the Central Valley, some wetland wildlife species have adapted to the artificial wetlands of some agricultural practices and have become dependent on these wetlands to sustain their populations. Agriculturally created wetlands include rice lands; fields flooded for weed and pest control; stubble management; and tailwater circulation ponds.*

Managing agricultural lands to increase forage for waterfowl and other wildlife will increase the survival rates of overwintering wildlife and strengthen them for migration, thus improving breeding success (Madrone Associates 1980)

Creating small ponds on farms with nearby waterfowl nesting habitat but little brood habitat will increase production of resident waterfowl species when brood ponds are developed and managed properly. Researchers and wetland managers with the DFG, U.S. Fish and Wildlife Service and the California Waterfowl Association have found that well managed brood ponds produce the high levels of invertebrates needed to support brooding waterfowl. Other wildlife such as the giant garter snake will also benefit. Restoring suitable nesting habitat near brood ponds *will increase the production of resident waterfowl species.*

Restoring nesting habitat, especially when it is near brood ponds, will increase the production of resident waterfowl species. When the restored nesting habitat is properly managed, large, ground predators are less effective in preying on eggs and young of waterfowl and other ground nesting birds. Managing agricultural lands to increase forage for waterfowl and other wildlife will increase the overwinter survival rates of wildlife and strengthen them for migration, thus improving breeding success (Madrone and Assoc. 1980)

REDUCING OR ELIMINATING STRESSORS

WATER DIVERSIONS

TARGET 1: Improve the survival of chinook salmon and steelhead in Butte Creek by helping to install positive-barrier fish screens (◆◆◆).

PROGRAMMATIC ACTION 1A: Improve the survival of juvenile chinook salmon and steelhead in Butte Creek by helping to the install screened portable pumps as an alternative to the Little Dry Creek diversion.

PROGRAMMATIC ACTION 1B: Increase the survival of juvenile chinook salmon and steelhead in Butte Creek by helping local interests to install positive-barrier fish screens at the Durham-Mutual Diversion Dam.

PROGRAMMATIC ACTION 1C: Increase the survival of juvenile chinook salmon and steelhead in Butte Creek by helping local interests to install positive-barrier fish screens at Adams Dam.

PROGRAMMATIC ACTION 1D: Increase the survival of juvenile salmon and steelhead in Butte Creek by helping local interests to install positive-barrier fish screens at Gorrill Dam.

PROGRAMMATIC ACTION 1E: Increase the survival of juvenile salmon and steelhead in Butte Creek by evaluating the need to install a positive-barrier fish screen at White Mallard Dam.

PROGRAMMATIC ACTION 1F. Increase the survival of juvenile salmon and steelhead in the Sutter Bypass by evaluating the need to install positive barrier fish screens on diversions.

RATIONALE: *Diverting, storing, and releasing water in the watershed directly affects fish, aquatic organisms, and nutrient levels in the system and indirectly affects habitat, foodweb production, and species abundance and distribution. Diversions cause water, nutrient, sediment, and organism losses. Seasonal and daily water release patterns from storage may affect habitat, water quality, and aquatic organism survival. Flood control releases into bypasses also cause adult and juvenile fish stranding.*

DAMS AND OTHER STRUCTURES

TARGET 1: Improve chinook salmon and steelhead survival in Antelope Creek by developing a cooperative program to reduce the use of seasonal diversion dams by 50% during the late spring, early fall, and winter (◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to evaluate the reduced use of seasonal diversion dams that may be barriers to migrating chinook salmon and steelhead in Antelope Creek by acquiring water rights or providing alternative sources of water.

TARGET 2: Develop a cooperative program to improve the upstream passage of adult chinook salmon and steelhead in Big Chico Creek by providing access to 100% of habitat located below natural barriers (◆◆).

PROGRAMMATIC ACTION 2A: Repair or reconstruct the fish ladders in Big Chico Creek to improve the upstream passage of adult spring-run chinook salmon and steelhead trout.

PROGRAMMATIC ACTION 2B: Repair the Lindo Channel weir and fishway at the Lindo Channel box culvert at the Five Mile Diversion to improve upstream fish passage.

TARGET 3: Develop a cooperative approach to ensure unimpeded upstream passage of adult spring-run chinook salmon and steelhead in Mill Creek (◆◆◆).

PROGRAMMATIC ACTION 3A: Cooperatively develop and implement an interim fish passage corrective program at Clough Dam on Mill Creek until a permanent solution is developed cooperatively with the landowners.

TARGET 4: Develop a cooperative program to improve the upstream passage of adult spring-run chinook salmon and steelhead in Butte Creek to allow access to 100% of the habitat below the Centerville Head Dam (◆◆◆).

PROGRAMMATIC ACTION 4A: Increase the opportunity for the successful upstream passage of adult spring-run chinook salmon and steelhead on Butte Creek by developing a cooperative program to evaluate the feasibility of removing diversion dams, providing alternative sources of water, or constructing new high-water-volume fish ladders.

PROGRAMMATIC ACTION 4B: Improve chinook salmon and steelhead survival and passage in Butte Creek by cooperatively developing and evaluating operational criteria and potential modifications to the Butte Slough outfall.

PROGRAMMATIC ACTION 4C: Increase chinook salmon survival in Butte Creek by cooperatively helping local interests to eliminate stranding at the drainage outfalls in the lower reach.

RATIONALE: *Dams and their associated reservoirs block fish movement, alter water quality, remove fish and wildlife habitat, and alter hydrological and sediment processes. Other human-made structures may block fish movement or provide habitat or opportunities for predatory fish and wildlife, which could be detrimental to fish species of special concern.*

HARVEST OF FISH AND WILDLIFE

TARGET 1: Develop harvest management strategies that allow the wild, naturally produced fish spawning population to attain a level that fully uses existing and restored habitat. Focus the harvest on hatchery-produced fish (◆◆◆).

PROGRAMMATIC ACTION 1A: Control illegal harvest by providing increased enforcement efforts.

PROGRAMMATIC ACTION 1B: Develop harvest management plans with commercial and recreational fishery organizations, resource management agencies, and other stakeholders to meet the target.

PROGRAMMATIC ACTION 1C: Reduce the harvest of wild, naturally produced steelhead populations where necessary by marking hatchery-reared fish and instituting a selective fishery.

PROGRAMMATIC ACTION 1D: Evaluate a marking and selective fishery program for chinook salmon.

RATIONALE: *Restoring and maintaining chinook salmon and steelhead populations to levels that fully take advantage of habitat may require restrictions on harvest during, and even after, the recovery period. Stakeholder organizations should help to ensure a balanced and fair allocation of available harvest. Target population levels may preclude existing harvest levels of wild, naturally produced fish. For populations supplemented with hatchery fish, selective fisheries may be necessary to limit the wild fish harvest, while hatchery fish harvest levels reduce their potential to disrupt the genetic integrity of wild populations.*

ARTIFICIAL PROPAGATION OF FISH

TARGET 1: Minimize the likelihood that hatchery-reared salmon and steelhead produced in Central Valley salmon and steelhead hatcheries will stray into non-natal streams to protect naturally produced salmon and steelhead (◆◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to evaluate the benefits of stocking hatchery-reared salmon and steelhead in the Sacramento River and Battle Creek. Stocking may be reduced in years when natural production is high.

TARGET 2: Limit hatchery stocking if salmon or steelhead populations can be sustained by natural production (◆◆◆).

PROGRAMMATIC ACTION 2A: Augment fall chinook salmon and steelhead populations only when alternative measures are deemed insufficient for populations recovery.

TARGET 3: Minimize further threats of hatchery fish contaminating naturally produced chinook salmon and steelhead stocks (◆◆◆).

PROGRAMMATIC ACTION 3A: Adopt methods for selecting adult spawners for the hatchery from an appropriate cross-section of the available adult population.

RATIONALE: *Hatchery augmentation should be limited to protect recovery and maintenance of wild populations. Hatchery-reared salmon and steelhead may directly compete with and prey on wild salmon and steelhead. Hatchery fish may also threaten the genetic integrity of wild stocks by interbreeding with the wild fish. Although irreversible contamination of the genetics of wild stocks has occurred, additional protective measures are necessary to minimize further degradation of genetic integrity. Because of the extent of development on the Sacramento River and Battle Creek, stocking chinook salmon and steelhead may be necessary to rebuild and maintain stocks to sustain sport and commercial fisheries.*

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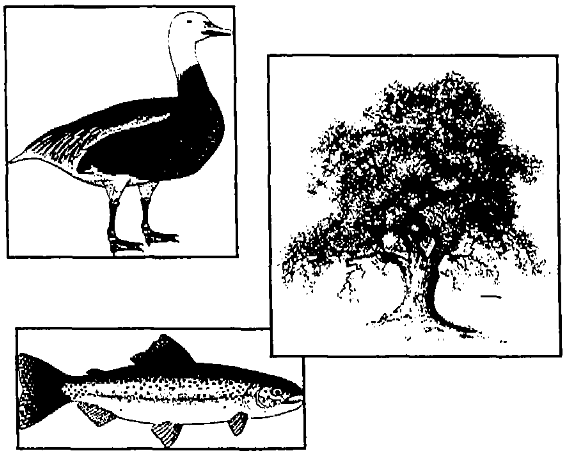
◆ Feather River/Sutter Basin Ecological Management Zone



Introduction

The Feather River/Sutter Basin Ecological Management Zone contributes to the health of the Sacramento-San Joaquin River Delta by sustaining ecological processes that support anadromous fish and other aquatic and terrestrial wildlife and plant habitats in this zone and in the Delta. Streamflow, sediment, and nutrients, including nitrogen, phosphorous, and organic detritus coming from this Ecological Management Zone, are all important to the Delta.

Chinook salmon, white sturgeon, green sturgeon, steelhead and lamprey are important anadromous fish species and striped bass and American shad are harvestable (sport) species that depend on healthy conditions in the Sacramento-San Joaquin Delta and Feather River/Sutter Basin Ecological Management Zones. The Feather River is important for spawning and rearing fall-run and spring-run chinook salmon, steelhead, white and green sturgeon, striped bass, and American shad. The Yuba River is important for fall-run chinook salmon, steelhead, and American shad, and potentially for spring-run chinook salmon. Bear River and Honcut Creek support small runs of fall-run chinook salmon. Sutter Bypass is an important migration route for spring-run and fall-run chinook salmon from Butte Creek. In most years, almost all populations of upper Sacramento River migratory fish are potentially affected by the Sutter Bypass. The bypass system (Tisdale, Colusa, and Moulton weirs) are configured such that at river flows exceeding approximately 22,000 cfs, flows begin to begin to be diverted into the bypass. During periods of high runoff, all flows above 30,000 cfs are diverted into the bypass. The Sutter Bypass also is an important spawning and rearing area for splittail, which migrate from the Bay-Delta each winter to spawn in flooded portions of the lower rivers, such as the Sutter Bypass. Under certain hydrologic conditions, bypass flooding may cause stranding and loss of juvenile fish and other aquatic resources.

Important ecological processes that would maintain or increase Feather River/Sutter Basin Ecological Management Zone health are:

- streamflow,
- coarse sediment supplies
- stream meander
- floodplain processes, and
- water temperature.

Important habitats include riparian wetlands, shaded riverine aquatic (SRA), freshwater fish habitat, and essential fish habitat. Seasonally flooded wetlands are common through the lower basin portions and are extremely important habitat areas for waterfowl, shorebird, and wading bird guilds. Important species include all runs of chinook salmon, steelhead trout, sturgeon, American shad, resident native fish guilds, waterfowl guilds, shorebird and wading bird guilds, and riparian wildlife guilds. Stressors, including flood control improvements, urbanization (floodplain encroachment), dams, legal and illegal fish harvest, insufficient flow in the lower portions of most streams, high water temperature during salmon spawning and egg incubation, poor water quality, stranding in flood bypasses and flood plains, hatchery stocking of salmon and steelhead, and unscreened or poorly screened water diversions, have affected the health of anadromous fish populations.

DESCRIPTION OF THE MANAGEMENT ZONE

The Feather River/Sutter Basin Ecological Management Zone includes the following Ecological Management Units:

- Feather River Ecological Management Unit
- Yuba River Ecological Management Unit
- Bear River and Honcut Creek Ecological Management Unit, and
- Sutter Bypass Ecological Management Unit.

These units provide habitat for a wide variety of fish, wildlife, and plant species.

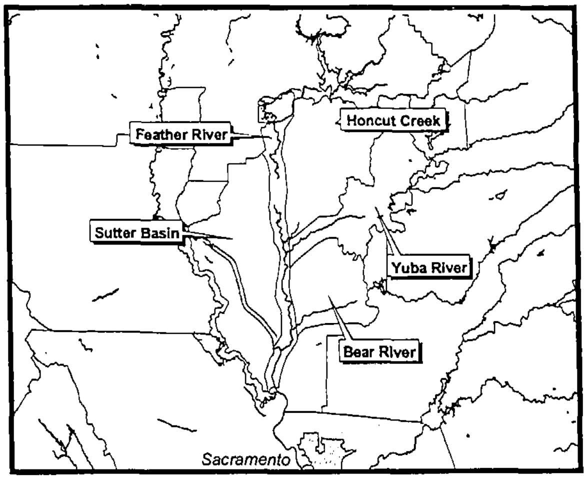
LIST OF SPECIES TO BENEFIT FROM RESTORATION ACTIONS IN THE FEATHER RIVER/SUTTER BASIN ECOLOGICAL MANAGEMENT ZONE

- green sturgeon
- white sturgeon
- chinook salmon
- steelhead trout
- striped bass
- American shad
- lamprey
- splittail
- waterfowl
- neotropical migratory birds
- plants and plant communities.

DESCRIPTIONS OF ECOLOGICAL MANAGEMENT UNITS

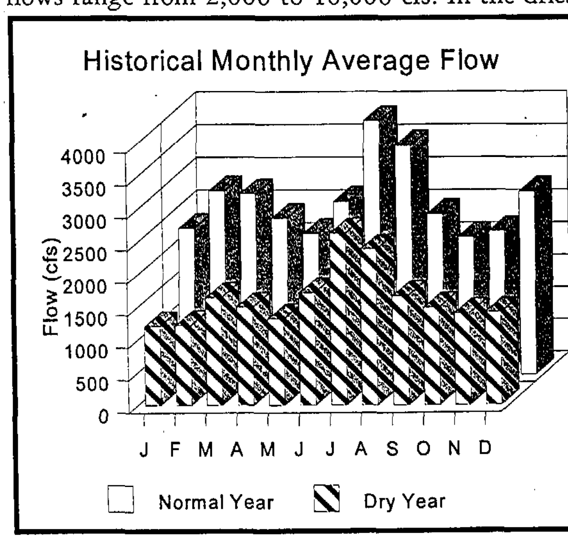
FEATHER RIVER ECOLOGICAL MANAGEMENT UNIT

The Feather River, with a drainage area of 3,607 square miles, is the largest Sacramento River tributary downstream of Shasta Dam. Watersheds of the various forks drain high-elevation ranges of the Cascade Range and Sierra Nevada. Numerous storage reservoirs are located on the river, including Lake Almanor and Butt Valley Reservoir on the North Fork, Lake Davis and Bucks Lake on the Middle Fork, and Little Grass Valley Reservoir on the South Fork. Oroville and Thermalito Reservoirs are on the mainstem below the forks, and major water diversion take place at both reservoirs. The lower Feather River downstream of Oroville picks up the flow of major tributaries, including Honcut Creek, the Yuba River, and the Bear River.



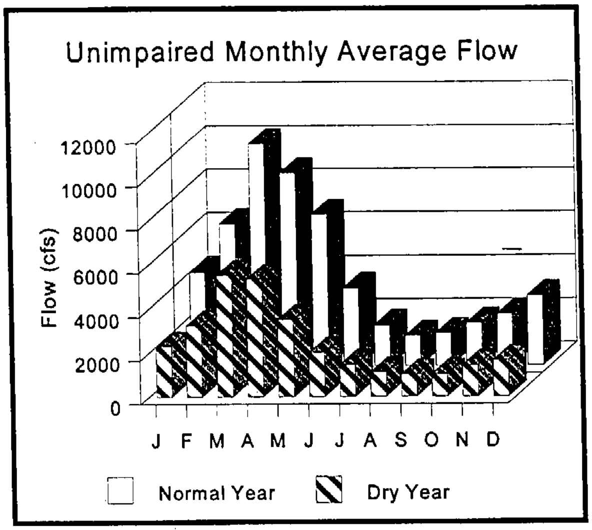
Location Map of the Feather River/Sutter Basin Ecological Management Zone and Units.

The Feather River has a natural (unimpaired) streamflow pattern typical of streams that drain the higher Cascade Range and Sierra Nevada elevations on the east side of the Sacramento Valley. Flows peak in winter and spring. Lower flows in summer and fall are sustained by snowmelt and foothill and mountain springs. In the wettest years, unimpaired monthly average flows in winter months average 24,000 to 48,000 cubic feet per second (cfs), whereas spring inflows are slightly lower at 18,000 to 28,000 cfs. In dry and normal years, winter and spring unimpaired flows range from 2,000 to 10,000 cfs. In the driest



Historical Streamflow on the Feather River below Oroville, 1972-1992 (Dry year is the 20th percentile year; normal year is the 50th percentile or median year.)

years, unimpaired flows in winter months average 1,100 to 1,500 cfs and spring flows average slightly higher at 1,500 to 2,000 cfs. The lowest unimpaired flows are 800 to 1,000 cfs in August through October of the driest years. Summer and early-fall flows are normally 1,000 to 2,000 cfs, except in years of high rainfall, when they range from 2,000 to 6,000 cfs.



Unimpaired Streamflow on the Feather River at Oroville, 1972-1992 (Dry year is the 20th percentile year; normal year is the 50th percentile or median year.)

The natural flow pattern has been altered by storage reservoirs in the middle and upper watersheds and diversions in the lower river. Comparing recent historical flows (1972 through 1992) and unimpaired flows for the same period near Oroville indicates impaired flow extent. With winter and spring inflows stored in reservoirs for summer and fall irrigation releases, there has been a shift in the river's flow pattern. In dry years, winter and spring flows have been reduced from 2,000 to 6,000 cfs to 1200 to 1,600 cfs. In normal years, the shift has been from 4,000 to 10,000 cfs to 2,000 to 3,000 cfs. In the driest years, winter and spring flows average about 800 to 900 cfs, compared to 1,100 to 1,500 cfs for unimpaired flow.

The opposite pattern is seen in summer and fall, when storage releases for irrigation increase base flows. Summer and fall flows in dry and normal years are approximately 50% to 60% higher than unimpaired flows. Highest flows are similar to unimpaired flows. In late summer and fall of driest years, unimpaired and historical flows are both in the 800 to 1,000 cfs range.

Oroville Reservoir, the lowermost reservoir on the Feather River, is the keystone of the State Water Project (SWP) operated by the California Department of Water Resources (DWR). Water is released from Oroville Dam through a multilevel outlet to provide appropriate water temperatures for the Feather River Hatchery and to protect downstream fisheries. Approximately 5 miles downstream from Oroville Dam, water is diverted at the Thermalito Diversion Dam into the Thermalito Power Canal, from there into the Thermalito Forebay and another powerhouse, and finally into Thermalito Afterbay. Water can be pumped from the Thermalito Diversion Pool back into Oroville Reservoir to generate peaking power. The Fish Barrier Dam, located approximately 1 mile below the Thermalito Power Canal intake, is the upstream limit of anadromous fish migration. The Oroville-Thermalito complex, completed in 1968, provides benefits to water conservation, hydroelectric power, recreation, flood control, and fisheries.

Feather River flows between the Thermalito Diversion Dam and the Thermalito Afterbay outlet are a constant 600 cfs. This river section is often referred to as the low-flow section. Water is released through a powerhouse, then through the fish barrier dam to the Feather River Hatchery, and finally into the low-flow section. Thermalito Afterbay serves both as an afterbay for upstream peaking-power releases to ensure constant river and irrigation canal flows, and as a warming basin for irrigation water being diverted to the rice fields. Because of warm water releases into the Feather River from Thermalito Afterbay, water temperatures in the approximately 14-mile section of salmon spawning area from the Thermalito Afterbay outlet to the mouth of Honcut Creek (referred to as the high-flow section) are higher than in the 8 miles

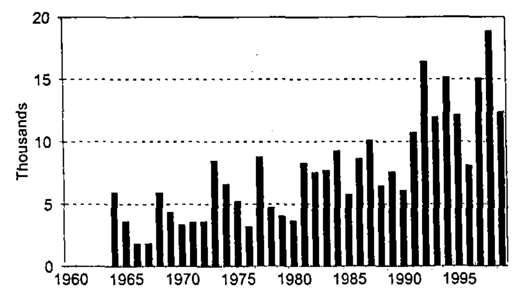
Oroville Dam on the Feather River (DWR Photo).

of the low-flow section. In recent years, the low flow section has been heavily used by fall-run chinook salmon spawners to the extent that overuse is a problem due to redd superimpostion (a situation in which fresh spawners dig up existing salmon nests in order to deposit their eggs).

Juvenile chinook salmon and other species of fish may become stranded on flood plain depressions, shallow ponds, and toe drains or borrow pits along the base of levees. In April 1998, thousands of young chinook salmon were found stranded in broad, shallow ponds on the flood plain near Nelson Slough. Stranding, under certain flow condition, may be a source of mortality to naturally produced chinook salmon in the Feather Basin. The losses probably occur from two sources, entrapment by which young fish are prevented from migrating downstream and through predation by resident warmwater gamefish such as largemouth black bass and other members of the sunfish family and predation by wading birds in the broad, shallow ponds. This flood plain stranding needs further evaluation, but limited engineering/technical evaluations indicate that many of the levee borrow pits could be hydrologically reconnected to the river to allow juvenile chinook to resume their seaward migration.

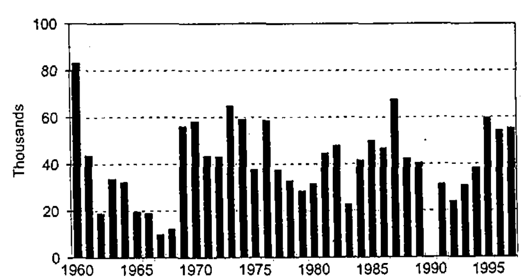
Important resources in the Feather River Ecological Management Unit include fall- and spring-run chinook salmon, steelhead, white and green sturgeon, striped bass, American shad, and lamprey. The Feather River Hatchery is the only Central Valley egg source for spring-run chinook salmon. Spring-run chinook salmon adults ascend the river in spring, hold over during summer in deep pools in the low-flow section, and are allowed into the hatchery in September. These fish are artificially spawned in the hatchery and also spawn naturally on the riffles in the low-flow section from late September to late October. Introgression (hybridization) of fall- and spring-run chinook salmon is a problem in the Feather River. About 20% of the tagged juvenile chinook salmon from females identified as spring run when returned were misidentified as fall-run. Similarly, about 29% of tagged juveniles from spring-run parents were misidentified as fall run when they returned as adults (Brown and Green 1997). A more recent analysis shows that in some years misidentification may be as high as 74%. Requirements for adult spring-run chinook salmon holding and early spawning influence the California Department of Fish and Game's (DFG's) water temperature and flow recommendations for the low-flow section.

Feather River spring-run chinook salmon population estimates during 1982 to 1991 averaged 2,800 fish. This is greater than the pre-project (i.e., SWP) average of 1,700 fish, primarily because of consistent cold-water deliveries to the hatchery and the low-flow section of the river. The Feather River spring-run chinook salmon's genetic status is uncertain. This stock may have hybridized with fall-run chinook salmon, but the extent of hybridization and the potential effect on spring chinook genetics in the Central Valley is unknown.



Fall-run Chinook Salmon Returns to Feather River Hatchery, 1964-1998 (CDFG 1999).

Most Feather River chinook salmon are fall-run fish that spawn in the low-flow section and below from October through December. As with spring-run fish, the present average run of fish returning to the hatchery and spawning in the river exceeds the pre-project population. In addition to spawning escapement, about 10,000 salmon (fall and spring runs combined) are harvested by anglers each year. During 1968-1993, Feather River Hatchery produced about 7.4 million fall-run and 1.2 million juvenile spring-run chinook salmon and about 750,000 juvenile steelhead annually.



Fall-run Chinook Salmon Returns to the Feather River (excluding hatchery returns), 1960-1998 (CDFG 1999).

Feather River steelhead are primarily hatchery stock, natural production of juveniles in the low-flow section appears to be limited, possibly due to elevated water temperatures in summer or scouring of redds. The 2,000 steelhead hatchery mitigation goal is comparable to the present 10-year (1982 to 1983 through 1991 to 1992) average return to the hatchery of 1,454 steelhead and an angler catch in the Feather River estimated as high as 7,785 fish. Steelhead juveniles must remain in the river or be held in the hatchery for at least one year until they are large enough to begin their anadromous journey. Appropriate water temperature and flow in the low-flow section are vital to continued Feather River steelhead program success.

American shad ascend the Feather River to spawn from April through June. The number of shad in the river, and thus the success of anglers, depends on the relative flow magnitude at the mouth of the Feather and Sacramento Rivers. In the 1987 to 1992 drought, Feather River flows in April through June were relatively low and the number of shad returning to the river was lower than average.

Striped bass spawn in the lower Feather River downstream of the Yuba River's mouth from April through June. Striped bass are found in the river during much of the year with a peak occurrence in July and August. Lamprey enter in the spring and early summer to spawn and their young remain for up to several years before migration to the ocean.

Yuba River Ecological Management Unit

The Yuba River watershed drains 1,339 square miles of the western Sierra Nevada slope and includes portions of Sierra, Placer, Yuba, and Nevada Counties. The Yuba River is tributary to the Feather River, which, in turn, feeds into the Sacramento River.

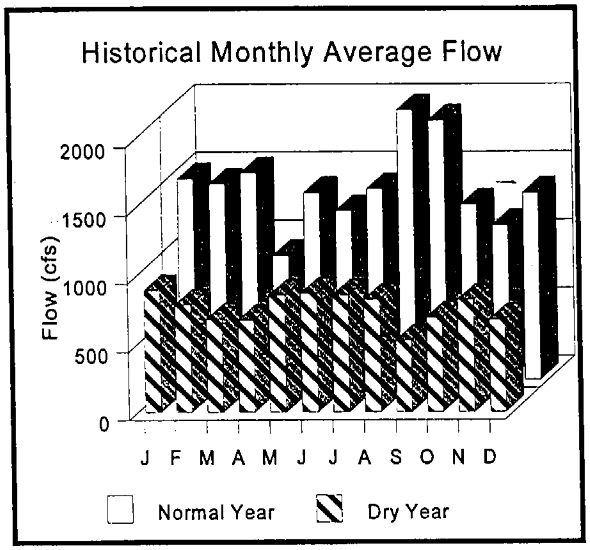
Three dams on the river have altered river flows and fish passage. Englebright Dam was built by the U.S. Army Corps of Engineers (Corps) in 1941 to collect placer mining debris that contributed to flooding in the Central Valley. Englebright Reservoir contributes storage capacity, hydropower, and cool, bottom-released water to the lower Yuba River. Most Englebright Reservoir water, the lowermost storage reservoir on the river and the upstream anadromous fish limit, is released through the Narrows 1 and 2 Englebright Dam powerhouses to generate hydroelectric power. The 0.2 mile of river between the dam and the two powerhouses has no flowing water unless the reservoir is spilling. The 0.7 mile of river from the Narrows 1 and 2 powerhouses to the Deer Creek mouth has steep rock walls; long, deep pools; and short stretches of rapids. Below this area, the river cuts through 1.3 miles of sheer rock gorge called the Narrows, forming a single large, deep, boulder-strewn pool.

The river canyon opens into a wide floodplain several miles beyond the downstream end of the Narrows, where large quantities of hydraulic mining debris remain from past gold-mining operations. This 18.5-mile section is typified as open-valley plain. Daguerre Point Dam, 12.5 miles downstream from Englebright Dam, is the major lower-river diversion point. The open plain continues 7.8 miles below Daguerre Point Dam to beyond the downstream Yuba Goldfields terminus. This section is primarily alternating pools, runs, and riffles, with a gravel and cobble substrate and contains most of the suitable lower Yuba River chinook salmon spawning habitat.

The remaining section of the lower Yuba River extends approximately 3.5 miles to its confluence with the Feather River. This river section is bordered by levees and is subject to Feather River backwater influence.

In the upper Yuba River watershed above Englebright Reservoir, storage reservoirs affect the natural flow pattern. The major storage reservoir is New Bullards Bar on the North Fork, with a storage capacity of about 1 million acre-feet (af) and a watershed area of 490 square miles. Fifteen other reservoirs have been constructed in the upper basin, with a combined storage capacity of 400,000 af. Power-generation diversions of about 100 cfs are made into the Feather River basin (from Slate Creek to Sly Creek), and about 600 cfs is diverted to the Bear River and Deer Creek watersheds for power and irrigation (from Lake Spaulding to Drum Canal and the South Yuba Canal). A major portion of the watershed is unregulated, however, and very high flows pass through Englebright Reservoir to the lower watershed during major storms.

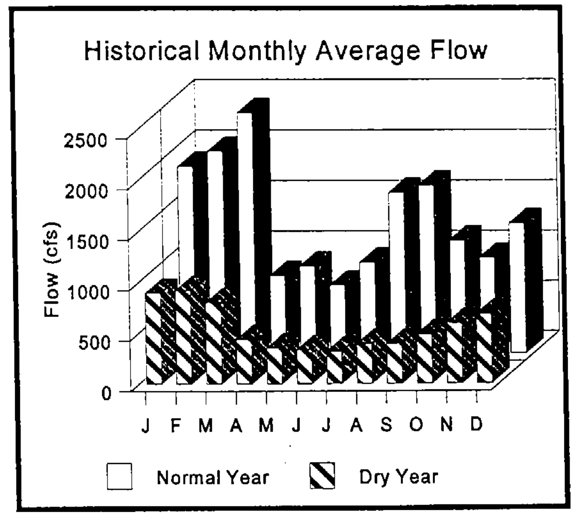
The natural, unimpaired flow pattern in the Yuba River is typical of Sacramento Valley tributaries with headwaters in the Sierra Nevada. Flows are highest in winter and spring, decreasing quickly in late spring. Annual inflow is highly variable. Basin inflows in winter months of years with the highest rainfall average 15,000 to 25,000 cfs, whereas inflow in the driest years averages 300 to 600 cfs. In the driest years, inflow in summer and early fall averages only 0 to 100 cfs. In dry and normal water years, average monthly inflows in summer and early fall are 200 to 600 cfs.



Historical Streamflows on the Yuba River below Englebright Dam, 1972-1992 (Dry year is the 20th percentile year; normal year is the 50th percentile or median year.)

New Bullards Bar and Englebright Reservoirs store winter and spring flows and distribute water more evenly throughout the year and from year to year. Summer and early-fall irrigation releases are substantially higher than unimpaired flows. In the driest years, reservoir releases increase base flows in summer and early fall by 0 to 100 cfs to 70 to 260 cfs. In dry years, summer flows are 500 to 900 cfs compared to unimpaired flows of 190 to 230 cfs. Spring flows in dry and normal years are 300 to 900 cfs, as compared to unimpaired flows of 700 to 1,200 cfs. In years with the highest rainfall, flows are similar to unimpaired flows, averaging 10,000 to 20,000 cfs in winter months.

Diversions in the lower river, primarily from just above Daguerre Point Dam, reduce lower river flows during the irrigation season. Flows from August through October at Marysville are generally higher than unimpaired flows, whereas flows from March through June are substantially lower. In the driest years, summer flows are 70 to 90 cfs and winter flows are 190 to 230 cfs. Spring flows in dry years are 340 to 440 cfs compared to unimpaired flows of 800 to 3,700 cfs.



Historical Streamflow on the Yuba River at Marysville, 1972-1992 (Dry year is the 20th percentile year; normal year is the 50th percentile or median year.)

The Yuba River is one of the most important Ecological Management Units in the Feather River/Sutter Basin Ecological Management Zone. The river supports highly valued populations of steelhead trout, resident rainbow trout, and fall-run chinook salmon, as well as populations of other anadromous and resident fish communities. The Yuba River is the only remaining wild steelhead fishery in the Central Valley. All other streams that have wild population, have population that are either so low that they do not support a fishery or are closed to angling. Spring-run chinook salmon abundance and status in the Yuba River is not known. Directed efforts are required to determine if it is a component of the fishery and whether additional management and restoration measures are required.

Fall-run chinook salmon is the most abundant anadromous fish species in the lower Yuba River. Historically, the Yuba River supported as much as 15% of the annual fall-run chinook salmon run in the Sacramento River system. Run sizes in the Yuba River have varied over the period of record (1953 to 1989), ranging from 1,000 fish in 1957 to 39,000 fish in 1982. Approximately 60% of those salmon spawned between Daguerre Point Dam and the Highway 20 bridge, with most of the remaining fish spawning above Highway 20 or below the dam.